

CLAIMS

What is claimed is:

1. A selectable mode clutch adapted to selectively couple an input member and an output member, the selectable mode clutch comprising:
  - a first race coupled for rotation with the input member about a central axis, the first race including a first bearing surface having a plurality of axial ridges;
  - a second race including a second bearing surface in facing relationship with the first bearing surface, the second bearing surface having a plurality of axial ridges;
  - a projection integrally formed with one of the first and second races;
  - a plurality of rollers positioned between the first and second bearing surfaces, the rollers engaging the axial ridges on the first and second bearing surfaces to radially displace the second race relative to the first race upon relative rotation between the first race and the second race; and
  - a control member rotatable about the central axis, the control member including a first receiving portion and a second receiving portion, one of the control member and the projection being movable along the central axis relative to the other of the control member and the projection between a first position, in which the projection is positioned in the first receiving portion to operate the clutch in a first mode, and a second position, in which the projection is positioned in the second receiving portion to operate the clutch in a second mode different from the first mode.

2. The selectable mode clutch of claim 1, wherein the first receiving portion includes a first slot in the control member, and wherein the second receiving portion includes a second slot in the control member.
3. The selectable mode clutch of claim 1, wherein the control member is coupled for rotation with the input member.
4. The selectable mode clutch of claim 1, wherein the projection is positioned in the first receiving portion to lock together the first race and the second race for co-rotation in the first mode of operation.
5. The selectable mode clutch of claim 1, wherein the projection is positioned in the second receiving portion to allow the first race to rotate about the central axis in a single direction relative to the second race in the second mode of operation.
6. The selectable mode clutch of claim 1, wherein the one of the control member and the projection is movable along the central axis relative to the other of the control member and the projection to a third position, in which the first race is rotatable about the central axis in any direction relative to the second race to operate the clutch in a third mode of operation.
7. The selectable mode clutch of claim 6, wherein the control member includes a third receiving portion, and wherein the projection is positioned in the third receiving portion to operate the clutch in the third mode of operation.

8. The selectable mode clutch of claim 6, wherein the one of the control member and the projection is movable along the central axis relative to the other of the control member and the projection to a fourth position, in which the first race is rotatable about the central axis in any direction relative to the second race to operate the clutch in the third mode of operation.

9. The selectable mode clutch of claim 8, wherein the third position corresponds with an outermost position of the one of the control member and the projection in a first direction along the central axis, and wherein the fourth position corresponds with an outermost position of the one of the control member and the projection in a second direction along the central axis opposite the first direction.

10. The selectable mode clutch of claim 1, wherein the projection is a first projection on the second race extending radially inwardly, wherein the first race includes a second projection extending radially outwardly, and wherein the control member is movable along the central axis relative to the first projection and the second projection.

11. The selectable mode clutch of claim 10, wherein the first receiving portion of the control member includes a first slot having a width substantially equal to a width of the first projection, wherein the control member includes a second slot having a width substantially equal to a width of the second projection, and wherein the first projection is positioned in the first slot and the second projection is positioned in the second slot to operate the clutch in the first mode.

12. The selectable mode clutch of claim 11, wherein the second receiving portion of the control member includes a third slot having a width greater than the first slot, and wherein the first projection is positioned in the third slot and the second projection is positioned in the second slot to operate the clutch in the second mode.

13. The selectable mode clutch of claim 12, wherein the control member includes a fourth slot having a width greater than the third slot, and wherein the first projection is positioned in the fourth slot and the second projection is positioned in the second slot to operate the clutch in a third mode different from the second mode.

14. The selectable mode clutch of claim 12, wherein the first and third slots are defined by adjacent projections extending radially outwardly from the control member, wherein the first projection is positioned outside an axial extent of the projections on the control member, and wherein the second projection is positioned in the second slot to operate the clutch in a third mode different from the second mode.

15. The selectable mode clutch of claim 11, wherein the first projection is positioned in the first slot, and wherein the second projection is positioned outside an axial extent of the second slot to operate the clutch in a third mode different from the second mode.

16. The selectable mode clutch of claim 1, wherein the control member includes at least one cylindrical member having at least two different size slots formed therein.

17. The selectable mode clutch of claim 16, wherein the control member includes a first cylindrical member having a first slot formed therein; and a second cylindrical member having a second slot formed therein, the second slot being wider than the first slot.
18. The selectable mode clutch of claim 1, wherein the projection is a radially-extending projection.

19. A clutch assembly adapted to selectively couple an input member and an output member, the clutch assembly comprising:

a selectable mode clutch including

a first race coupled for rotation with the input member about a central axis,

the first race including a first bearing surface having a plurality of axial ridges;

a second race including a second bearing surface in facing relationship

with the first bearing surface, the second bearing surface having a plurality of axial ridges;

a projection integrally formed with one of the first and second races;

a plurality of rollers positioned between the first and second bearing surfaces, the rollers engaging the axial ridges on the first and second bearing surfaces to radially displace the second race relative to the first race upon relative rotation between the first race and the second race; and

a control member rotatable about the central axis, the control member including a first receiving portion and a second receiving portion; and

an actuator operable to move one of the control member and the projection along the central axis relative to the other of the control member and the projection between a first position, in which the projection is positioned in the first receiving portion to operate the clutch in a first mode, and a second position, in which the projection is positioned in the second receiving portion to operate the clutch in a second mode different from the first mode.

20. The clutch assembly of claim 19, wherein the first receiving portion includes a first slot in the control member, and wherein the second receiving portion includes a second slot in the control member.

21. The clutch assembly of claim 19, wherein the control member is coupled for rotation with the input member.

22. The clutch assembly of claim 19, wherein the projection is positioned in the first receiving portion to lock together the first race and the second race for co-rotation in the first mode of operation.

23. The clutch assembly of claim 19, wherein the projection is positioned in the second receiving portion to allow the first race to rotate about the central axis in a single direction relative to the second race in the second mode of operation.

24. The clutch assembly of claim 19, wherein the one of the control member and the projection is movable along the central axis relative to the other of the control member and the projection to a third position, in which the first race is rotatable about the central axis in any direction relative to the second race to operate the clutch in a third mode of operation.

25. The clutch assembly of claim 24, wherein the control member includes a third receiving portion, and wherein the projection is positioned in the third receiving portion to operate the clutch in the third mode of operation.

26. The clutch assembly of claim 24, wherein the one of the control member and the projection is movable along the central axis relative to the other of the control member and the projection to a fourth position, in which the first race is rotatable about the central axis in any direction relative to the second race to operate the clutch in the third mode of operation.

27. The clutch assembly of claim 26, wherein the third position corresponds with an outermost position of the one of the control member and the projection in a first direction along the central axis, and wherein the fourth position corresponds with an outermost position of the one of the control member and the projection in a second direction along the central axis opposite the first direction.

28. The clutch assembly of claim 18, wherein the projection is a first projection on the second race extending radially inwardly, wherein the first race includes a second projection extending radially outwardly, and wherein the control member is movable along the central axis relative to the first projection and the second projection.

29. The clutch assembly of claim 28, wherein the first receiving portion of the control member includes a first slot having a width substantially equal to a width of the first projection, wherein the control member includes a second slot having a width substantially equal to a width of the second projection, and wherein the first projection is positioned in the first slot and the second projection is positioned in the second slot to operate the clutch in the first mode.

30. The clutch assembly of claim 29, wherein the second receiving portion of the control member includes a third slot having a width greater than the first slot, and wherein the first projection is positioned in the third slot and the second projection is positioned in the second slot to operate the clutch in the second mode.

31. The clutch assembly of claim 30, wherein the control member includes a fourth slot having a width greater than the third slot, and wherein the first projection is positioned in the fourth slot and the second projection is positioned in the second slot to operate the clutch in a third mode different from the second mode.

32. The clutch assembly of claim 30, wherein the first and third slots are defined by adjacent projections extending radially outwardly from the control member, wherein the first projection is positioned outside an axial extent of the projections on the control member, and wherein the second projection is positioned in the second slot to operate the clutch in a third mode different from the second mode.

33. The clutch assembly of claim 29, wherein the first projection is positioned in the first slot, and wherein the second projection is positioned outside an axial extent of the second slot to operate the clutch in a third mode different from the second mode.

34. The clutch assembly of claim 19, wherein the actuator includes a shifter fork operable to move the one of the control member and the projection between the first position and the second position.

35. The clutch assembly of claim 34, further comprising a flange coupled for rotation with the one of the control member and the projection about the central axis, wherein the shifter fork engages the flange to move the one of the control member and the projection between the first position and the second position.

36. The clutch assembly of claim 19, wherein the actuator includes a solenoid operable to move the one of the control member and the projection between the first position and the second position.

37. The clutch assembly of claim 19, wherein the actuator includes an expandable hydraulic chamber operable to move the one of the control member and the projection between the first position and the second position.

38. The clutch assembly of claim 19, wherein the control member includes at least one cylindrical member having at least two different size slots formed therein.

39. The clutch assembly of claim 19, wherein the control member includes a first cylindrical member having a first slot formed therein; and a second cylindrical member having a second slot formed therein, the second slot being wider than the first slot.

40. The clutch assembly of claim 19, wherein the projection is a radially-extending projection.